Transverse Spin Dependent Azimuthal Correlations of Charged hadron(s) in $p^{\uparrow}p$ Collisions at $\sqrt{s} = 200$ GeV

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Abstract

The transversity distribution function, $h_1^q(x)$, a leading twist parton distribution function, is a fundamental component of the spin structure of the nucleon. $h_1^q(x)$ describes the distributions of transversely polarized quarks inside a transversely polarized nucleon, where x is the longitudinal momentum fraction of the proton carried by quark q. It is loosely constrained by global fits. Being chiral odd, $h_1^q(x)$ can be accessed only when it is coupled with another chiral-odd partner, such as the spin-dependent Collins fragmentation function (FF) or the interference fragmentation function (IFF), which serves as a quark polarimeter. In transversely polarized proton-proton ($p^{\uparrow}p$) collisions, the resulting azimuthal correlation between the spin of the fragmenting quark and the final state single charged hadron in jets (involving Collins FF) or di-hadron (involving IFF) can be measured, which are sensitive to quark transversity. The STAR experiment at RHIC has previously measured IFF asymmetries for $\pi^+\pi^-$ pairs using $p^{\uparrow}p$ collision data from 2006 at $\sqrt{s} = 200$ GeV ($\int Ldt = 1.8\ pb^{-1}$) and from 2011 at $\sqrt{s} = 500$ GeV ($\int Ldt = 25\ pb^{-1}$) and Collins asymmetries for charged pions within jets from 2011 at $\sqrt{s} = 500$ GeV. Non-zero IFF and Collins asymmetries were reported which are consistent with predictions based on global analyses of e^+e^- and SIDIS data. In 2012 and 2015, STAR collected $\sim 14\ pb^{-1}$ and $\sim 48\ pb^{-1}$ of $p^{\uparrow}p$ data at $\sqrt{s} = 200$ GeV, respectively. These datasets provide the most precise measurements of the Collins and IFF asymmetries in $p^{\uparrow}p$ collisions at $\sqrt{s} = 200$ GeV to date, especially at the quark momentum fractions $0.1 < x < 0.4$. We will present preliminary results for Collins asymmetries of identified pions, kaons, and protons in jets based on 2012 and 2015 $p^{\uparrow}p$ datasets and the status update for IFF asymmetries based on 2015 $p^{\uparrow}p$ dataset at $\sqrt{s} = 200$ GeV.